International Journal of Computer Networking, Wireless and Mobile Communications (IJCNWMC)
ISSN(P): 2250-1568; ISSN(E): 2278-9448
Vol. 5, Issue 4, Aug 2015, 9-18

DATA FORWARDING BASED ON INTEREST USING ABC ALGORITHM IN SAN

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ABSTRACT

Mobile networks are new emergent technology now a days. Socially aware networking (SAN) is the one of the latest technology that supports store and forward mechanism. SAN is a new paradigm to improve the network performance in today's internet. SAN considers the social properties for routing and forwarding protocol for taking forwarding decisions. The focus of this paper is to design system based on interests of the people inspired from Artificial Bee Colony Algorithm. It considers the individuals' identifying and learning capability to gather information of density and social tie during communication. Node division is based on the single or multiple interest to form a intra community or inter community. This system handles the dynamic environment be using learning capability and mutual cooperation of individuals. In this paper, we propose the algorithm for multiple interests based scheme for forwarding using ABC algorithm. Also the algorithms for buffer management and message scheduling are designed for improving performance. The simulation results show that this system outperforms PROPHET and Epidemic in message delivery ratio, overhead and hop count, average latency, and average buffer time.

KEYWORDS: SAN, DTN, Routing, Forwarding, ABC Algorithm, Multiple Interest

INTRODUCTION

SAN is a new concept introduced to handle the network problems as it uses the social properties of individuals like relationship, trajectory. These social properties are used to design some new data routing and forwarding protocols. SAN works similarly to DTNs and OppNets. Basically, they are all lack of end-to-end routes from source node to destination node due to the dynamic topology induced by the mobility of nodes. Commonly used concepts in SAN are social tie, interest. The people generally have the interest in same data files or information so that the people having same interest meet regularly; they have tight bonding with each other. Additionally, future mobility can be detected by using the individual's mobility patterns. However, SAN is faced with some challenges, including how to conduct community construction and detection, predict future encounters, and calculate social relationship efficiently. There are some challenges like changing network topology, the constrained resources, and the potential congestion.

The appropriate solution is needed to solve the problem of adaptability to dynamic environment. One technique called swarm intelligence has provided some knowledge regarding the detect and adapt to the changes of environment in timely manner. The ABC algorithm is example of this, which shows the bee's working to search for nectar as well as detect the changing density.

RELATED WORK

DTN Routing

Epidemic routing is used for eventual delivery of messages to arbitrary destinations with minimal assumptions is

supported by epidemic routing. It handles the underlying topology and connectivity of the underlying network. This protocol is to distribute application messages to hosts, called *carriers*, within connected portions of ad hoc networks. In this way, messages are quickly distributed through connected portions of the network. Epidemic Routing then relies upon carriers coming into contact with another connected portion of the network through node mobility. At this point, the message spreads to an additional island of nodes. Through such transitive transmission of data, messages have a high probability of eventually reaching their destination.

PROPHET is the node's mobility is not a random but it is a repeating behavior. In this scheme, assumption is there that mobile nodes tend to pass through some locations more than others, implying that passing through previously visited locations is highly probable. Here in this, the nodes that met each other in the past are likely to meet in the future. PROPHET proposed for improve the delivery probability and reduce the wastage of network resources in Epidemic routing.

Swarm Intelligence

Biological society can perform complex tasks like resource management and task allocation, social differentiation, and synchronization (or desynchronization), by just relying on the cooperation among social individuals (e.g. insects). Surprisingly, the law governing the biological system is a small number of simple generic rules, without any external controlling entity. Several typical algorithms have set good examples on how swarm intelligence help tackle problems in various fields. [10]

The artificial bee colony algorithm is one of them [3]. Mohan and Baskaran[8] surveyed the recent research and implementation of ant colony optimization and proposed SMACO[5], an improved ant colony optimization model to solve network routing problem. The artificial bee colony algorithm imitates the bees' behaviors to search for nectar sources, which tends to attain the optimal division of labor in bee. The scout bees search the nectar in a random direction and gather information in the meantime. The search results are called PATCH, involving food density in an area and the rough direction. When scout bees return to the hive, they perform a characteristic dance called waggle dance in order to project the PATCH. Then, according to the PATCH, a proper number of scout bees are assigned to work as follower bees on the best patch sites, for it is them who found these sites.[3]

OVERVIEW OF SYSTEM

This system includes first, it enhances the adaptability to dynamic environments through exploiting swarm intelligence. Second, it classifies communities based on personal interests into specified categories. This eliminates the cost of community detection and construction. Furthermore, nodes exchange their interest information (i.e. their exact interests) when they are in transmission range, in order to predict the environment information and social tie. The interest information is small enough to reduce the congestion. In addition, mobile nodes process limited information which saves resources including buffer and energy [3].

Model of the Proposed System

In this work, we consider an application scenario which is close to reality. We consider three kinds of mobile object: pedestrians, cars and buses. Each object is equipped with a mobile (for a pedestrian) or a vehicle (for a car or a bus) device. The device on a vehicle is controlled by the driver and we omit the influence of passengers. They communicate

with each other through wireless interfaces e.g. Bluetooth or WiFi. We refer to these devices as nodes in this paper. The application aims at effective routing through these mobile nodes.

Operating Principle of Community Formation

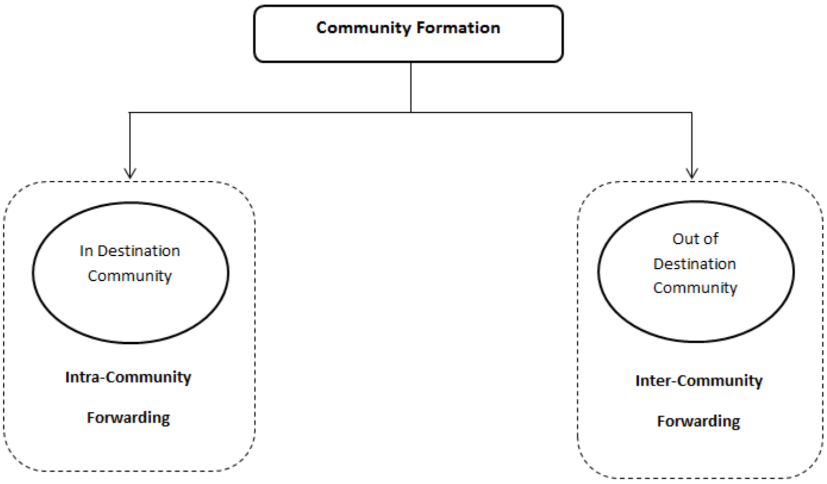

Figure 1: Community Formation

Figure1 shows Community is the basis of forwarding data. It uses interest as the measure to construct community. According to the forwarding strategy, data are forwarded among nodes. If the relay nodes are out of destination community, the inter-community forwarding strategy is used to forward data close to the destination community as quickly as possible. If the relay nodes are in the destination community, the intra-community forwarding strategy is used to forward data to the central node and the central node can forward the data to the destination. [2]

Components of Proposed System

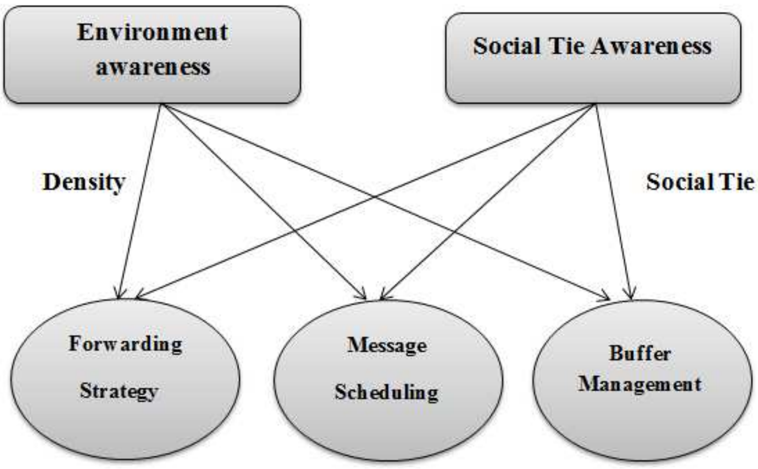

Figure 2: Components of Proposed System

Figure 2 *depicts the five components of system:* Here Mobile nodes are divided into various communities based on interests may be single or multiple and those with the same interest usually exchange messages frequently. We do not have to detect communities but to select forwarders according to information obtained from the environment. According to nodes' interests, Environment Awareness can perceive the number of passing nodes with different interests in a period of

time, which we name density. The bigger the density, the more nodes can be met. Providing that individuals usually have repeated mobility patterns, the density information can be used to select forwarders. In one community, its members will contact frequently. Thus BEEINFO [3] maintains social tie between nodes according to the contact records. The social tie information is utilized to select the forwarders in intra-community forwarding process. Thus, we design Social Tie Awareness to collect social tie information in community from contact history. Based on the density and social tie information, Forwarding Strategy takes different strategies to select the forwarders under intercommunity and intra-community conditions. BEEINFO [3] also incorporates Message scheduling and Buffer Management to further enhance the forwarding efficiency. [3]

D.Design of the Proposed System

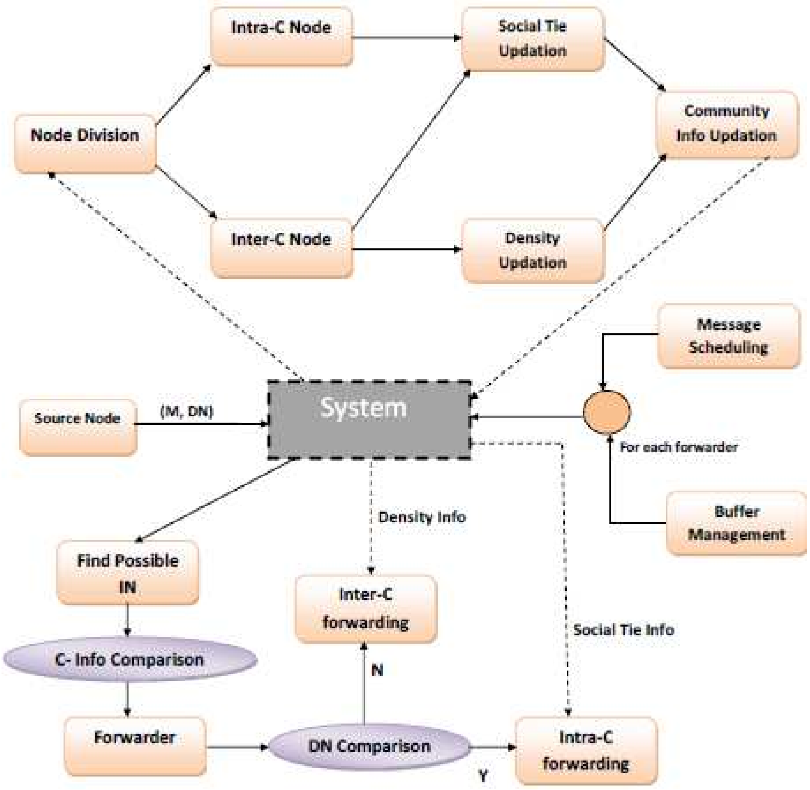

Figure 3: Architecture of the System

Figure 3: shows the architecture of proposed system. Here, advantage of individual's awareness and learning capability by imitating bee's behaviors. Mobile nodes perceive and record information (e. g densities) of passing communities. Nodes exchange their interest information in transmission range. Every node records or updates the density of communities according to exchanged interest information. Density is the number of nodes belonging to a community. If the community has more nodes, the density is high.

ALGORITHM OF PROPOSED SYSTEM

By taking inspiration from the ABC that is Artificial Bee Colony Algorithm concept in the swarm intelligence. Algorithm for the proposed system is designed.

Environment and Social Awareness

In BEEINFO, environment awareness and social tie awareness gather density and social tie information, respectively. To be specific, density is the number of nodes a mobile user encounters over a time window T. In addition, considering the influence of the past and present information, BEEINFO predicts density based on the exponentially weighted moving average, similar to [3]. After that, an evaporation process is performed to weaken the influence of previous density.[3]

$$Density_i(t) = \sum_{t=0}^{T} n \tag{1}$$

$$\begin{aligned} Density_i(t + \Delta t) \quad = \quad & \alpha \times Density_i(t - \Delta t) \\ & +(1 - \alpha) \times Density_i(t) \end{aligned} \tag{2}$$

$$Density_{new} = Density_{old} \times \gamma^k \tag{3}$$

As given in formula (1),(2),(3).This is the computational formula for calculating density. Where α is community density prediction, γ is a evaporation factor, K is time interval.

$$SoTie_{i,j}(t) = (\lambda_{i,j} \times d_{i,j}(t))/T \tag{4}$$

$$\begin{aligned} SoTie_{i,j}(t + \Delta t) \quad = \quad & \beta \times SoTie_{i,j}(t - \Delta t) \\ & +(1 - \beta) \times SoTie_{i,j}(t) \end{aligned} \tag{5}$$

$$SoTie_{new} = SoTie_{old} \times \gamma^k \tag{6}$$

As given in formula (4), (5), (6) here, λi, j is the contact frequency and di, j is the contact duration of i and j in time window T. β in is social tie prediction factor.

Steps:

1: for all nodes INs connected to node SN do

2: //In time window T:

3: if Is == Ii then

4: //Update contact information

5: if SN has the social tie record of IN then

6: Update social tie information with (3);

7: else

8: Initiate the social tie to IN in SN;

9: end if

10: Update the intra-community density with (1);

11: else

12: //Update inter-community contact info

13: if SN has density record of IN then

14: Update density information with (1);

15: else

16: Initiate the density of IN in SN;

17: end if

18: end if

19: //When time is multiple of T

20: Predict density information with (2);

21: Predict present social tie with (4);

22: end for

Forwarding Strategy

Forwarding strategy of BEEINFO is given in following algorithm. The information of destination node (DN), including ID and interest, is contained in the message. When a source node (SN) meets with an intermediate node (IN), firstly, they compare their interests and see if they belong to the same community, and then compare density or social tie information to decide whether IN is a good forwarder. Specifically, density is for inter-community forwarding and social tie is for intra-community process. Note that when making a decision, BEEINFO follows the rule that intra-community forwarding is prior to inter-community process. After comparison, our scheme takes different actions to deal with distinct situations, as described below.

Steps:

1: Given a message M in the buffer of a node;

2: for all IN do

3: if IN is DN then

4: Deliver M from SN to IN;

5: else

6: if Ii == Id then

7: //IN belongs to destination community

8: if Is == Id then

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            //SN belongs to destination community
            if SoTie(SN;DN) < SoTie(IN;DN)then
                    Deliver M from SN to IN;
            end if
        else
        Deliver M from SN to IN;
      end if
    else
if Is! = Id then
                    //Ii!=Id and Is!=Id
          if density of SN < density of IN for Id then
                    Deliver M from SN to IN;
          end if
        end if
    end if
end for
```

Message Scheduling

When IN is selected as forwarder, then there might be another SN's who selected the same IN as forwarder. So, each SN handovers message to that IN. Now here IN is having multiple messages to be delivered to no. of destinations (DNs).Message scheduling is used here to priorities messages so that transmission rate will be increased.

Steps:

Consider a msg M and M1 is next msg

1. If Id==I; then

Place M at top of list for all DN do

if So Tie(IN,DN)>= SoTie(IN,DN+1)

then M with DN placed at top

2. If Id!=I; then

For all M do

If density of DN (associated with M)>DN+1(associated with M1)

Then place M at top of list

Buffer Management

Each forwarder is having a fixed size buffer to store messages to be delivered. Time to time buffer need to be cleaned.

e.g

- When forwarder delivers a messages
- When M is having lower density
- When M is having lower social tie
- These two messages to be discarded

Steps:

- If DN found then
  - Deliver messages M
  - Clear M from buffer
- Recorder all messages according to density values associated with DN of each messages M
- If buffer is full and new messages is coming then discard M with lowest density.
  - Recorder all messages according to social tie values
  - If buffer is full and new messages is coming then discard m with lowest social tie

RESULTS AND DISCUSSIONS

We have conducted preliminary simulations on BEEINFO, PROPHET [5], and Epidemic [4]. The simulations were conducted with the Opportunistic Network Environment Simulator [9] in Points of Interest (POIs) movement. The metrics to evaluate the protocols are message delivery ratio, overhead, average latency and hop count. Overhead is the ratio of relayed messages (delivered messages excluded) and delivered messages. The protocols' performance is evaluated over various simulation times (5000~30000 s). Nodes move with speeds from 0.5 m/s to 1.5 m/s in the area of 8000×7800 m2. The message size varies in the range of 500~1024 kB. To calculate density and social tie, α and β are both assigned 0.3, and γ is 0.98. Other parameters are set with default values and not listed here given the limited space.

We ran the simulation 6 times and calculated the average values. The results in Figure 4 display that generally BEEINFO keeps the same trends with PROPHET and Epidemic, in terms of delivery ratio, overhead and hop count. Specifically, this system achieves the highest delivery ratio, with the changing parameters. The overhead of system is far lower than those of PROPHET and Epidemic. Besides, it takes less than 3 hops to successfully deliver messages for this system, which is also the best among the protocols.

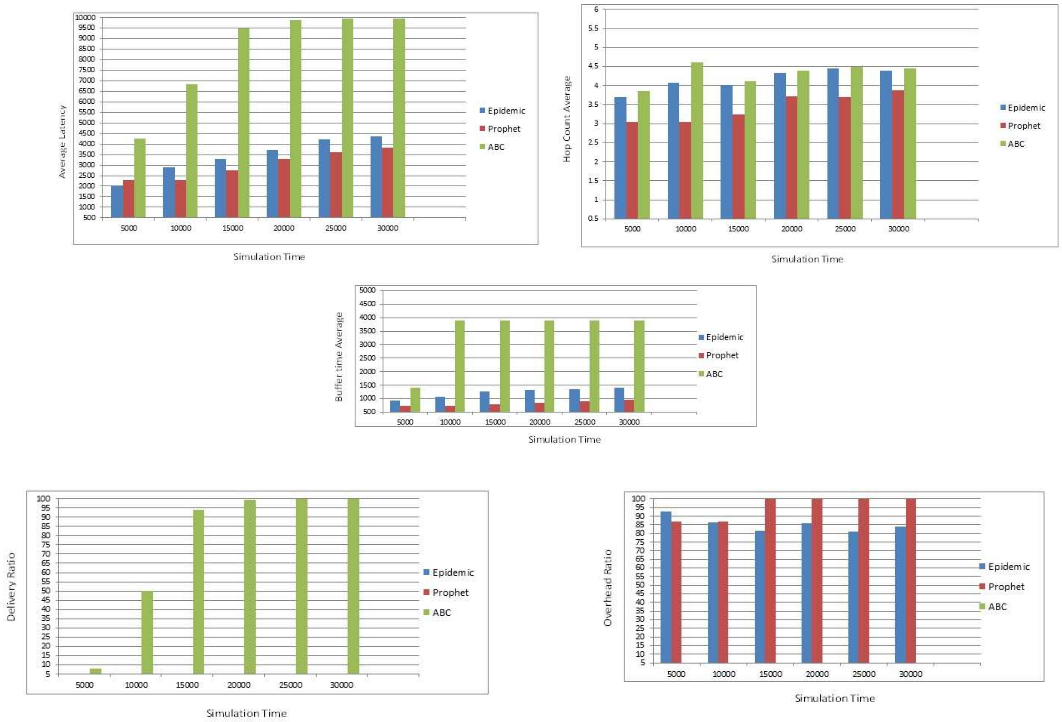

Figure 4: Graph of Result

CONCLUSIONS

We have proposed a set of interest-based forwarding schemes which is inspired by artificial bee colony, in the context of socially-aware networking. This system takes advantage of both bio-inspired networking and socially-aware networking. It has strong adaptability to the dynamic environment by fully harnessing the cooperation of individuals, making it suitable to mobile (social) networks like vehicular social networks. It perceives densities of passing communities and social tie according to interests may be single or multiple. Here both the inter community as well as intra-community scenarios are handled. Here we introduced the algorithm of handling multiple interests. Additionally, introduces message scheduling strategy and buffer management algorithm to improve the delivery rate. We proposed this system to handle delay and use the store and forward mechanism.

FUTURE WORK

We intend to consider the nodes with multiple interests and their relationships as future work. An algorithm for multiple interests is the proposed work. For example, a node with 2 interests of course belongs to 2 respective communities. When interests exchanges occurs, single interest based process for each interest. Same for selecting forwarder check interest, compare, select.

ACKNOWLEDGEMENTS

Our heartfelt thank goes to KJ College of Engineering and management Research, Pune for providing strong platform to develop our skills and capabilities. I would like to thank to my guide and respective teachers for their constant and valuable support and motivation. Last but not least, I would like to thank all who directly or indirectly helped me in processing the paper.

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